PHYSICS

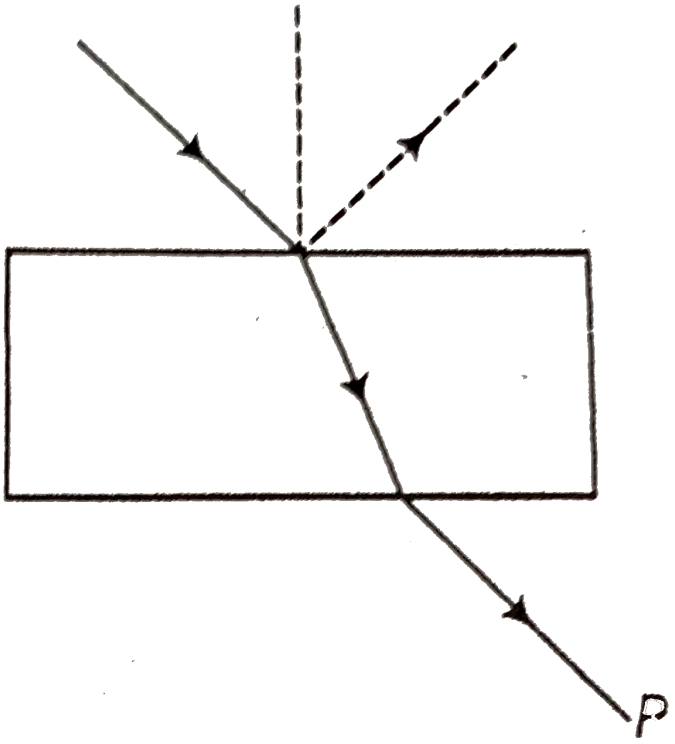
BOOKS - NCERT PHYSICS (HINGLISH)

WAVE OPTICS

Wave Optics

1. Consider a light beam incident from air to a glass slab at Brewster's angle as shown in figure.

A polaroid is placed in the path of the emergent ray at point P and rotated about an axis passing through the centre and pependicular to the plane of the plaroid.



A. for a particular orientation, there shall be darkness as observed through the polaroid

B. The intensity of light as seen through the polaroid shall be independent of the rotation

C. The intensity of light as seen through the polaroid shall go through a minimum but not zero for two orientations of the polaroid

D. The intensity of light as seen through the polaroid shall go through a minimum for four orientations of the polaroid

Answer: C

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2. Consider sunlight incident on a slit of width $10^4 Å$. The image seen through the slit shall

A. be a fine sharp slit white is colour at the centre

B. a bright slit white at the centre diffusing to zero intensities at the edges

C. a bright slit white at the centre diffusing to regions of different colours

D. only be a diffused slit white in colour

Answer: A

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3. Consider a ray of light incident from air onto a slab of glass (refractive index n) of width d, at an angle θ . The phase difference between the ray reflected by the top surface of the glass and the bottom surface is

A. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}+\pi$

B. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}$

C. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}+\frac{\pi}{2}$

D. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}+2\pi$

Answer: A

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4. In a Young's double slit experiment, the source is white light. One of the holes is covered by a red filter and another by a blue filter. In this case

A. there shall be alternate interference patterns of red and blue

B. there shall be an interface pattern for red distinct from that for blue

C. there shall be no interface fringes

D. there shall be no interface pattern for red mixing with one for blue

Answer: C

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5. Figure shows a standard two slit arrangement with slits S_1, S_2. P_1, P_2 are the two minima points on either side of P (Figure). At P_2 on the screen, there is a hole and behind

P_2 is a second 2-slit arrangement with slits S_3, S_4 and a second screen behind them.

A. There would be no interference pattern on the second screen but it would be lighted

B. The second screen would be totally dark

C. There would be a single bright point on the second screen

D. There would be a regular two slit pattern on the second screen.

Answer: D

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6. Two source S_1 and S_2 of intensity I_1 and I_2 are placed in front of a screen [Figure a]. The pattern of intensity distribution see in the central portion is given by Figure b. In this case which of the following statement are

true.

A. S_1 and S_2 have the same intensities.

B. S_1 and S_2 have a constant phase difference

C. S_1 and S_2 have the same phase

D. S_1 and S_2 have the same wavelength

Answer: A::B::D

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7. Consider sunlight incident on a pinhole of width 10^3Å. The image of the pinhole seen on a screen shall be

A. a sharp white ring

B. different from a geometrical image

C. a diffused central spot, white in colour

D. diffused coloured region around a sharp central white spot

Answer: B::D

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8. Consider the diffraction pattern for a small pinhole. As the size of the hole is increased

A. the size decrease

B. the intensity increase

C. the size increase

D. the intensity decrease

Answer: A::B

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9. For light diverging from a point source

A. the wavefront is spherical

B. the intensity decrease in proportion to the distance squared

C. the wavefront is parabolic

D. the intensity at the wavefront does not depend on the distance.

Answer: A::B

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10. Is Huygen's principle valid for longitudinal sound waves?

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11. Consider a point at the focal point of a convex lens. Another convex lens of short focal length is placed on the other side. Then the

nature of wavefront emerging from the final image.

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12. What is the shape of the wavefront on earth for sunlight ?

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13. Why is the diffraction of sound wave more evident in daily experience than that of light

wave ?

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14. The human eye has an approximate angular resolution of $\phi = 5.8 \times 10^{-4}$ rad and a typical photo printer prints a minimum of 300 dpi (dots per inch, $= 2.54cm$). Aminimum distance 'z' should a printed page be held so that one doesnot see the indivdual dots is _____ .

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15. A polariod (I) is placed infront of a monochromatic source. Another polariod (II) is placed in front of this polaroid (I) and rotated till no light passes. A third polaroid (III) is now placed in between (I) and (II). In this case, wil light emerge from (II) . Explain.

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16. Can reflection result in plane polarised light if the light is incident on interface from

the side with higher refractive index?

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17. For the same objective, the ratio of least separation between two points to be distiguised by a microscope for light of 5000Å and electrons acclerated through 100V used as illuminating substance is _____ (neraly)

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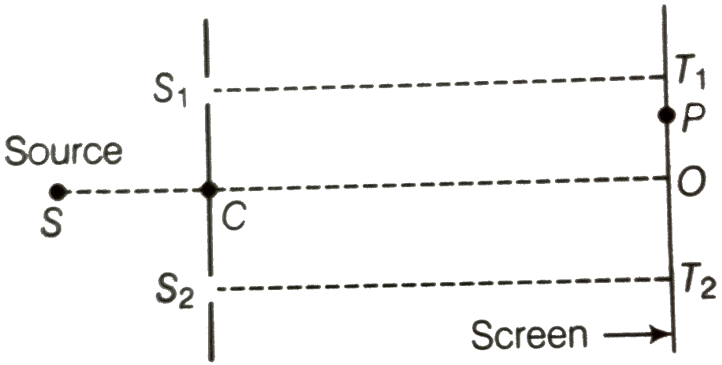
18. Consider a two slit interference arrangements (figure) such that the distance of the screen from the slits is half the distance between the slits. Obtain the value of D in terms of λ such that the first minima on the screen falls at a distance D from the centre O.



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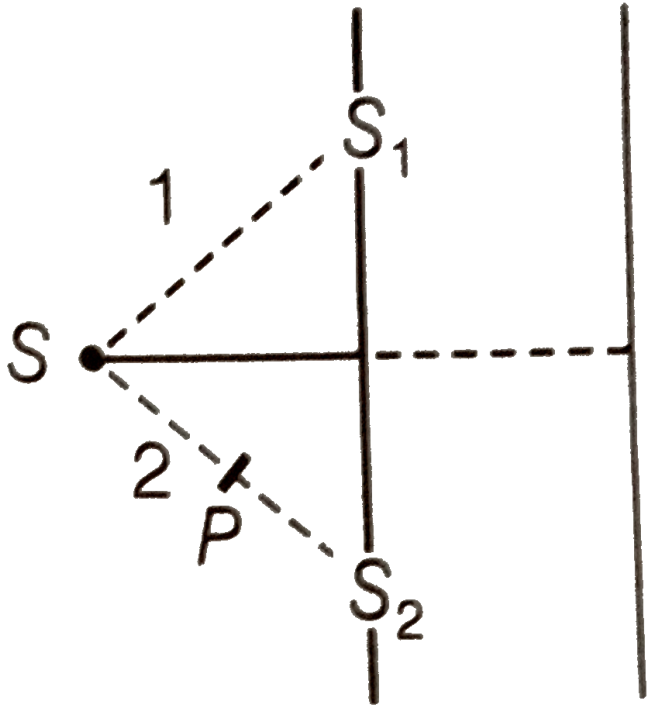
19. Figure shown a two slit arrangement with a source which emits unpolarised light. P is a polariser with axis whose direction is not given. If I_0 is the intensity of the principal maxima when no polariser is present, calculte in the present case, the intensity of the

principal maxima as well as the first minima.



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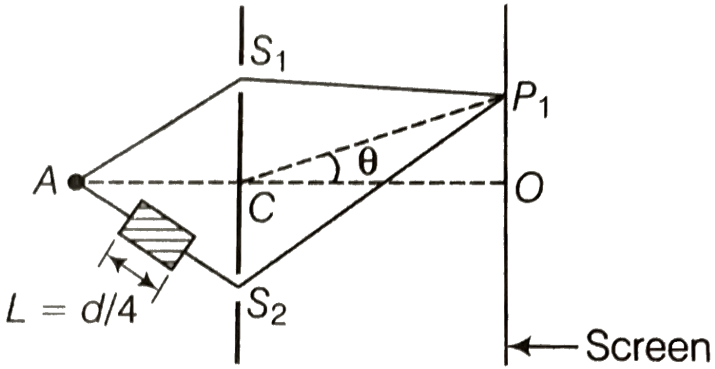

20.

A small transparent slab containing material of $\mu = 1.5$ is placed along AS_2(figure). What will be the distance from O of the principle maxima and of the first minima on either side of the principal maxima obtained in the absence of the glass slab ?

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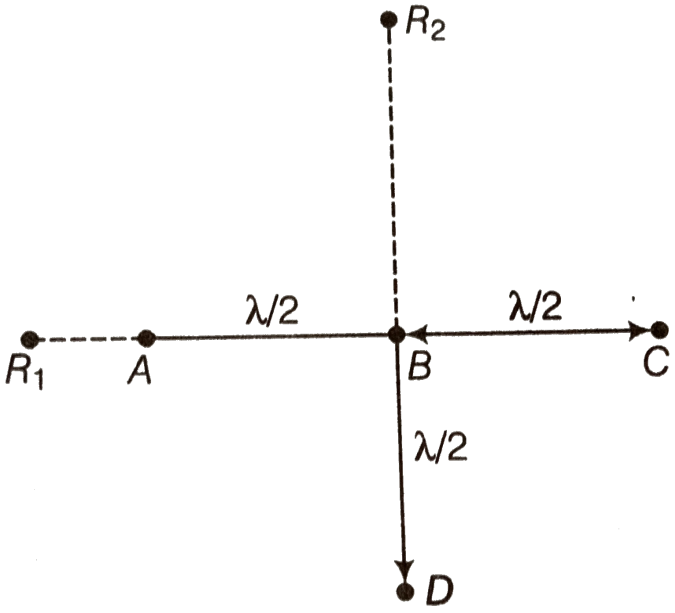
21. Four identical monochromatic sources A,B,C,D as shown in the (figure) produce waves of the same wavelength λ and are coherent. Two receiver R_1 and R_2 are at great but equal distances from B.

(i) Which of the two receivers picks up the larger signal when B is turned off?

(iii) Which of the two receivers picks up the larger singnal when D is turned off ?

(iv) Which of the two receivers can distinguish which of the sources B or D has been turned

off ?



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22. The optical properties of a medium are governed by the relative permittivity (ε_r) and relative permeability (μ_r). The refractive index

is defined as $\sqrt{\mu_r \varepsilon_r} = n$. For ordinary material, $\varepsilon_r > 0$ and $\mu_r > 0$ and the positive sign is taken for the squre root.

In 1964, a Russian scientist V. Veselago postualted the existance of material with $\varepsilon_r < 0$ and $\mu_r < 0$. Since, then such metamaterial have been produced in the laboratories and their optical properties studied. For such materials $n = -\sqrt{\mu_r \varepsilon_r}$. As light enters a medium of such refractive index the phases travel away from the direction of propagation.

(i) According to the description above show

that if rays of light enter such a medium from air (refractive index =1) at an angle theta in 2nd quadrant, then the refracted beam is in the 3rd quadrant.

(ii) Prove that Snell's law holds for such a medium.

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23. To ensure almost 100% transmittivity, photographic lenses are often coated with a thin layer of dielectric material, like

$MgF_2(\mu = 1.38)$. The minimum thickness of the film to be used so that at the centre of visible spectrum $(\lambda = 5500\text{Å})$ there is maximum transmission.

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